THE HEALTH EDUCATION JOURNAL

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Editorial

This is the era of large-scale efforts to persuade whole nations to think about the same thing at the same time. The objective is positive action to bring about human betterment, and so we have in 1960 World Refugee Year and World Mental Health Year. Much on the lines of a public relations exercise the various nations are being informed through the mass media of communication of the plight of the unfortunate in their midst, and what is the responsibility of individuals, communities and governments.

In the case of refugees the action is more or less straightforward. This needs money and those who willingly give their money have a clearcut idea of how it will be used. Refugees need repatriation, rehabilitation and jobs, and families need uniting. In addition to money and resources the normal formalities between countries need relaxation to enable these ends to be achieved. Human relationships are involved, and in particular there is a need to avoid hostilities which may arise from the fear that an influx of refugees may rob others of their employment or impoverish their standard of living.

However, one thing is certain, the approach is made to those who are not themselves refugees and who cannot imagine the possibility of their ever being so. This is in contrast with the problem of mental health.

In cultivating public opinion on the subject of mental illness, there is another aspect, which is that no individual can regard himself with complete confidence as being immune. He is liable to mental sickness from time to time as he is liable to a common cold, and the chances that he will need psychiatric treatment are increasing every day.

One task of Mental Health Year is the final elimination of prejudice and misunderstanding regarding mental illness and its treatment. The reform of mental treatment has proceeded slowly under the influence of public opinion, and now we see the present stage of the therapeutic community which has evolved from the older phases of guardianship and hospital treatment. This story needs unfolding for the public's information, and it is also necessary to show how the community itself shares responsibility.

This is not entirely preventive, however. For the prevention

of mental illness community education in human relationships is necessary. We now have a considerable body of reasonably precise information which will help us to build up a new mental climate which would not be too rigorous for the more susceptible members of the community and which at the same time would retain stimulating qualities for the more robust.

Although a good deal of work has been going on in this direction, particularly in the field of child care and development, we lack the media to reach the whole of the population. On the other hand these media exist, and there are signs that those in charge of them have a shrewd perception of these problems and are encouraging the production of material which, although superficially of entertainment value, at the same time reveals the depths of human emotions.

Ibsen was very skilful in this direction, though he lacked the modern powerful and intimate media, but a recent television play* suggests that the mantel of Ibsen has fallen on the shoulders of the Canadians, who have for long been recognised as brilliantly successful in the production of mental health films. In this play we saw the destructive effects of the deprivation of affection in an adult, leading to compensatory behaviour by display of smothering affection, desire to overprotect, and the elimination of competitors for affection by a curious accident-proneness. We wonder how much discussion took place in family circles after viewing this play. It is in the discussion of such programmes that the educational effort is made. Whatever the result, here is a formidable challenge to those who attempt to educate for mental health.

**The Song of Louise in the Morning*, ITV Channel 9, 19th February.

Correction

Dr. A. W. Young has asked us to point out that in the September 1959 issue of the Health Education Journal (page 154) he was incorrectly described as Medical Officer of Health of Hobart, Tasmania. Dr. Young is in fact M.O.H. to the Clarence Municipality, which comprises the eastern suburbs of Hobart. We apologise both to him and to Dr. N. B. Abbott, M.O.H. to the city of Hobart.

AN INTRODUCTION TO RADIATION AND ITS HAZARDS

By JAMES MAGUIRE, M.B., B.CH., D.P.H., D.R.C.O.G.,
Assistant County Medical Officer of Health, Armagh.

SINCE the discovery of x-rays by Roentgen in 1895, x-rays and radioactive substances have played a significant part in the service of humanity. Over the past 15 years, there has been a rapid growth in the production and uses of radioactivity. As well as being of benefit to man, this work has created new dangers. Many people are now concerned with the possible hazards of such work, and in the methods of preventing irreparable damage to the present and future generations.

Before dealing with these hazards it would be appropriate to describe what is meant by the term radiation. Since radiation is the product of things which happen inside an atom, in contrast to chemical reactions which involve many atoms, it will be necessary to describe the structure of an atom.

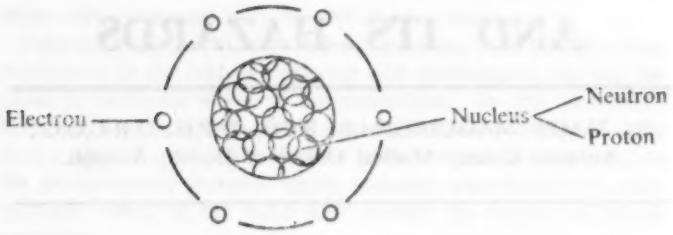
Atomic and nuclear structure

All matter is made from simple substances called elements, of which 90 occur in nature and a further dozen or so have been made in the laboratory. The smallest portion of any element is an atom. All atoms with the exception of the hydrogen atom have the same basic structure with a positively charged nucleus surrounded by electrons. The nucleus is composed of protons and neutrons.

The electrons possess a negative charge, are very light, and can be easily added to or removed from the atom in small numbers. Changes of this kind are responsible for chemical reactions. Nearly all the chemical and physical properties of a material are determined by the number and arrangement of its electrons.

The protons in the nucleus have a positive charge which

neutralises the negative charge of the electrons. Thus an atom in its normal state has the same number of protons as electrons, so that the atom is electrically neutral. The neutron has no charge but its relative mass is the same as the proton.



Structure of an Atom.

Properties of an Atom

	Relative Mass	Relative Charge
Proton	1	+1
Neutron	1	0
Electron	$\frac{1}{1840}$	−1

Atomic Number = Number of protons in the nucleus.
Mass Number = Total number of protons and neutrons in the nucleus.

Nuclei are either stable, in which case they show no physical or chemical reactions, or else unstable, in which case they display the property of radioactivity. The unstable nucleus of an atom has all the properties of the stable nucleus of the same type of atom. The additional instability of the nucleus is due to a change in the number of its neutrons. This addition or removal of neutrons disturbs the stability of the nucleus and results in the production of radioactive isotopes. These atoms have the same atomic number but different mass number.

Example. Take the sodium atom. It has 11 protons, 12 neutrons and 11 electrons. It has a relative mass of 23 and Atomic No. 11. If we add a neutron to its nucleus the relative mass becomes 24. This substance has all the properties of sodium (since its atomic number is still 11), but its nucleus is unstable due to the extra neutron and gives rise to a radioactive isotope. Every element

has a number of isotopes, most of which are unstable. There are more than 1,500 known isotopes at the present time, of which 300 are stable and 1,200 are radioactive. (Lenihan 1959).

Types of radiation

Radioactivity is a spontaneous disintegration of the nucleus, found in about 50 isotopes of natural occurrence and in about 1,000 which have been made artificially. Particles which may be projected from these radioactive substances are :

(1) *Alpha Particle.*—This is a helium nucleus consisting of 2 protons and 2 neutrons bound together. An example of this is the radium atom with 88 protons and 138 neutrons, which is an unstable combination, and sooner or later this atom disintegrates, emitting a helium nucleus (or alpha particle) with 2 neutrons and 2 protons. This radium atom now becomes radon with atomic number 86 and mass number 222. Radon is also radioactive and a whole series of radioactive decays takes place before a stable combination of protons and neutrons is reached. In 1 gm. of radium 3.7×10^{10} atoms will disintegrate per second and in any mass of radium, one-half of the atoms will disappear in about 1,600 years (Roberts). Alpha particle emission is not the commonest form of radioactivity. Much commoner is the beta emission.

(2) *Beta Particles.*—Beta rays are high speed electrons emitted from the nucleus undergoing radioactive decay. (They are not emitted from the shells around the nucleus.) The usual procedure is that a neutron inside the nucleus changes into a proton and an electron. The proton remains behind changing the atomic number by one unit and the electron is ejected as a beta particle. The alternative process is that a proton may change into a neutron and a positron (a positively charged electron). In this case the neutron remains and the positron escapes in the radioactive process.

(3) *Gamma Rays.*—When an alpha or beta particle is emitted the re-arranged daughter nucleus is in a highly excited condition due to its excess energy. It returns to normal by emitting a gamma ray. These may be emitted spontaneously from the nuclei of radioactive atoms. In biological effect and other properties they are similar to x-rays.

X-rays are produced artificially by the sudden retardation of fast moving electrons, usually in an electrical discharge tube with a heavy metal target, positively charged to attract electrons emitted by a heated tungsten filament. The electrons come to rest on

reaching the target and most of their energy is turned into heat, but a small proportion appear as x-radiation. All of these varieties of rays have certain properties in common ; for example, they all travel at the same speed—3 $\times$ 10^{10} cm/sec., i.e. 186,000 miles per sec., which is the speed of light.

Absorption of nuclear radiations

The most important property of alpha, beta and gamma rays is their ability to ionise. This means the removal of electrons from the atoms of the material through which they are passing. Ionisation is the basis of the biological effects of radiation and it is also used in many detecting and measuring devices. Alpha rays are good ionisers but do not penetrate very far. They can be intercepted quite markedly by a sheet of paper. They are not a serious external danger, but they are highly destructive once they have penetrated. Electrons from the commonly used radioactive isotopes have ranges in tissues of a few mm. They travel for most of this distance without much loss of energy but they cause fairly intense ionisation near the end of the path. Gamma rays are more penetrating than beta rays ; they cause relatively little ionisation, but penetrate considerable thickness of solid materials. The penetrating power is conveniently measured by the half-value layer, which is the thickness of absorbing material needed to reduce the intensity of the rays by half.

Decay of radioactive substances

All radioactive materials decay according to an exponential law, that is, the decay will never reach zero. The rate of decay is conveniently indicated by the half-life which is the time required for half of the initial activity to disappear. After 2 half-lives the activity falls to one-quarter, and so on. Half-lives of the useful artificial radioactive isotopes vary between a few seconds and a few years. Some of the natural radioactive elements have very long half-lives, e.g. radium 226 (1,600 years) and uranium 238 (4.5 x 10^9 years).

SOURCES OF RADIATION

Radiation occurs both from naturally occurring radioactive materials, such as rocks, and from those developed by man. The former does not constitute any serious hazard. The sources created by man are numerous and present many problems in the control of radiation hazards.

Radioactive fall-out from nuclear explosions

It has been known for some years that the radioactive debris from a nuclear explosion may be widely distributed over the earth's surface. When a nuclear weapon is exploded, the surrounding air is heavily contaminated with radioactive material. At the moment, there are 3 types of bomb.

(*a*) The atomic or fission bomb using uranium 235. In this explosion 0.1% of the fissile material is converted to radiation (chiefly heat, light and gamma rays) and the remainder is converted into fission products which are mainly radioactive isotopes of lighter elements. This type of bomb was used in Hiroshima.

(*b*) The hydrogen or fusion bomb in which the atomic bomb acts as a trigger initiating a momentary thermo-nuclear reaction in a surrounding mass of hydrogenous material. So far, this type of bomb has not been perfected.

(*c*) The fusion-fission bomb (or hydrogen-uranium bomb), first used in Bikini in 1954, and subsequently made in Russia. In this the hydrogen bomb is surrounded by a large mass of ordinary uranium metal. The fusion reaction releases a great number of neutrons which, by themselves, are no great hazard. In passing through the outer uranium jacket they produce fission in the uranium, converting it into radioactive products.

The significance of these developments lies in the fact that the atomic bomb has to be small, but the hydrogen-uranium bomb can be fitted with a very large uranium jacket, limited only to the carrying capacity of the aircraft. The amount of uranium converted to fission products in an atomic bomb is roughly 2 kg. ; in a hydrogen-uranium bomb it is roughly 1,000 kg.

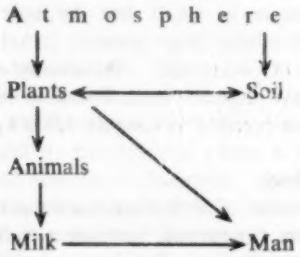
Behaviour of fall-out

After an explosion of a hydrogen-uranium weapon, the bomb and its casings are vapourised, forming a radioactive cloud which rises to about 100,000 feet. The large particles of debris descend in a few days and the remainder of the solid matter sinks slowly to a level of about 48,000 feet, where it remains. After a few weeks the cloud is dispersed over the earth's surface and the radioactive dust in the stratosphere falls to the ground at the rate of about 10% per year. In the United Kingdom, most of the fall-out is brought down by rain. The short-lived fission products decay in the stratosphere and do not reach the ground in appreciable quantities. The important isotopes deposited on the surface of the earth are cæsium 137 (half-life 33 years) and strontium 90 (half-

life 20 years). Cæsium is relatively innocuous but strontium presents a serious hazard.

Radioactive strontium is being deposited on the earth's surface at a measurable concentration. In 1954 the deposit in the U.K. was 2 millicuries of strontium 90 per square mile. In April, 1956, the level had risen to 13 mc/sq. mile. At the present time it is probably 20-25 mc/sq. mile. The radioactive material already accumulated in the stratosphere will continue for some years to deposit strontium at the rate of about 6 mc/sq. mile/year. Nothing can be done to reduce this rate of fall. The rate of fall-out depends on the number of hydrogen-uranium bombs exploded.

Since grass and other growing crops are being dusted with radioactive strontium, some of this material is already present in milk as well as certain animal and human tissues. The cow eats the grass and rejects four-fifths of the ingested strontium 90. One-fifth of its intake goes into milk. When a child drinks the milk, he absorbs more than one-fifth of the strontium 90 present in the milk and deposits it in his bones. In adults this is not so hazardous since their bones are not growing. Where cows are fed on highlands with thin grass, they will have to ingest the grass which has been exposed over a greater area. Thus cows fed on thick lowland grass do not get as much strontium 90.



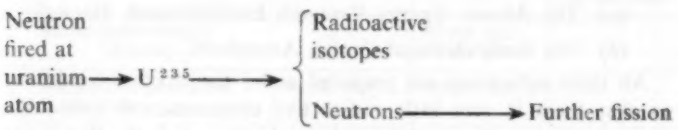
Cycle of Fission Products

Nuclear fission

Atomic energy—both in its military and its peaceful applications—depends on the process of nuclear fission.

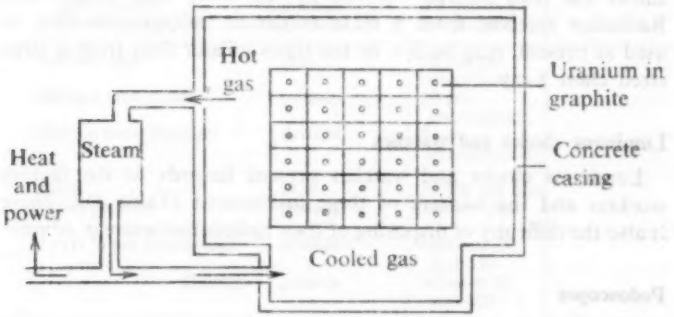
Fission of Uranium.—Uranium has two principal isotopes, U^{235} (0.7%) and U^{238} (99.3%). When U^{235} is bombarded by neutrons it undergoes fission, breaking into two sizeable pieces,

representing radioactive isotopes of higher elements, and a number of small fragments including 2 or 3 neutrons. Each neutron is capable of causing another fission under suitable conditions. It is therefore possible to set up a self-maintained chain reaction. This process can be made to go explosively (as in the atomic bomb) or more gradually as in a nuclear reactor.



Nuclear Fission Process

Neutrons from fission are very fast and have to be slowed down in order to keep the chain reaction going. This is accomplished by means of a moderator, composed of graphite and heavy water.



Nuclear Reactor.

A nuclear reactor has 3 main products :—

(i).—Heat, released during the fission process. In a nuclear power station this heat is partly converted into electrical energy.

(ii).—*Fission Products*.—When a uranium atom suffers fission, most of its mass is redistributed into two fragments, each of which is a radioactive isotope of a lighter element e.g. strontium 90 iodine 131, and cæsium 137. When a reactor has been working for a certain period the fuel rods must be changed. The partly used uranium is stored for a time to allow for the decay of short-lived

isotopes among the fission products. The unused uranium is recovered leaving a residue of highly radioactive fission products.

(iii).—The abundant supply of neutrons released in a fission process may be used for preparing radioactive isotopes by bombardment of stable materials placed inside the reactor. There are two main sources of radioactive isotopes :

(*a*) The Atomic Energy Research Establishment, Harwell.

(*b*) The Radiochemical Centre, Amersham.

All these substances are prepared under the strictest conditions so that there is very little radioactive contamination unless the reactor goes out of control through overheating, as in the Windscale incident.

Diagnostic radiology

This presents a more serious hazard to the community than nuclear power stations or fall-out from bomb explosions. Table 1 shows the high dosage received by the body with each x-ray. Radiation received from a mass miniature radiographic film, as used at present, may be five or ten times greater than from a large sized chest x-ray.

Luminous clocks and watches

Luminous clocks and watches present hazards to the factory workers and the wearers of these instruments (Table 1). There is also the difficulty of disposing of their radioactive waste products.

Pedoscopes

Use of this shoe-fitting x-ray apparatus has gradually increased in this country. They present an unnecessary hazard. The operator may have no idea of radiation and its dangers. It is quite common to see a child hold its foot in a machine for upwards of 1 minute so that the rest of the family may be entertained viewing the bony structure of the foot.

Industrial uses

The principal use of radiation in industry at present is the application of x-rays and radiations from radioactive materials to the radiography of castings, forgings and welds which are examined for cracks and flaws. Fluoroscopy, where an x-ray machine

TABLE I.

Estimates of radiation background, 1958. (Lenihan)

Source of radiation	Part of body considered	Dose received mr	
Cosmic	whole body (indoors)	35 per year	at sea level (doubles for each 6,000 ft. of altitude)
Rocks (sedimentary)	„	40 per year	
(granite)	„	70 per year	
Radioactive potassium in the body	whole body	18 per year	
Radioactive carbon in the body	whole body	2 per year	
Wrist watch with luminous dial (1 μc radium at 1 foot distance for 12 hours per day)	wrist	8,000 per year	
	gonads	30 per year	
X-ray examination :			
chest	skin	250 per film	
chest (male)	gonads	0.3 per film	
chest (female)	gonads	0.1 per film	
Barium meal	skin	50,000 per examination	
Barium meal (male)	gonads	20 per examination	
Barium meal (female)	gonads	9 per examination	
Pelvis	skin	20,000 per film	
Pelvis (female)	gonads	200 per film	
Average per film (male)	gonads	between 35 and 350	
(female)	gonads	between 60 and 600	
Shoe fitting x-ray	feet	at least 500 per fitting	depends on state of machine and other factors
	gonads	?	
70 ordinary atomic explosions 1951-1955 :			
first transit	whole body	3.5	in U.K.
eventual total	„ „	5	„ „
Hydrogen-uranium bomb (Bikini, March 1954) :			
total to March 1956	whole body	2.5	„ „
eventual total	„ „	29	„ „
11 atomic and hydrogen bombs to 1958 :			
eventual total	„ „	200	

throws an image of an object on to a fluorescent screen is frequently used for the detection of foreign bodies in food. The exposure of plastic materials to radiation increases their resistance to heat. The application of large doses of radiation for sterilisation of food will kill all bacteria and viruses while causing only minimal heating of the material. It also enables food to be preserved in the raw state. Smaller quantities of radiation ($\frac{1}{2}$ million rads) are adequate to inactivate food poisoning salmonella organisms in frozen whole egg and this is used commercially.

By giving insects radioactive materials we can follow their paths. For example, it has been found that cockroaches released in sewer manholes do not move far away, but mosquitoes have an effective dispersal range of 6 kilometres, while houseflies disperse over 2 to 14 kilometres. Other experiments have been done by putting radioactive baits in privy pits. In one experiment radioactive flies were recovered in 8 out of 10 nearby houses. Radioisotopes have been used in research on waterborne diseases involving drinking water analysis, as a tracer in studies of sewage oxidation ponds, and in a variety of sanitary research problems. (Lenihan 1959).

Clinical application of radioactive isotopes

Small amounts of some artificially made isotopes can be used to study the flow or metabolism of important elements in human and animal subjects. Used in this way the isotopes are called radioactive tracers. This type of experiment is possible because the artificially made isotopes display simultaneously two distinct kinds of behaviour. They have the same electronic structure as the corresponding stable elements and therefore the same chemical properties and physical appearance. In addition, they have the characteristic properties of radioactivity, conferred by an unstable nucleus. Radioactive isotopes may be detected very easily, by their beta or gamma radiation, in amounts much below the limits of ordinary chemical methods. Chemical or biological tests will seldom disclose the presence of aggregations containing less than 10^{12} atoms ; radioactive assay will detect quantities of 10^{8} atoms and sometimes very much less.

The value of artificially-prepared radioactive isotopes is enhanced by the fact that their properties are not affected by chemical manipulation or by metabolic changes inside the body.

Tracer experiments are carried out with a few microcuries of isotopes which are not themselves particularly dangerous. Neither

the patient nor the operators are subjected to an appreciable hazard during this type of experiment.

The principal uses of radioactive materials in clinical and biological work are :

(*a*) as tracers for elucidating metabolic processes.

(*b*) as tracers for studying the distribution and movement of blood and other fluids.

(*c*) as therapeutic agents.

For tracer tests we take advantage of two properties :

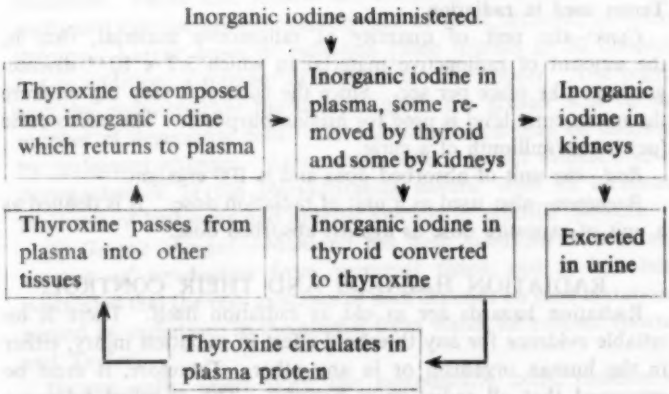
(*a*) radioactive isotopes are indistinguishable in chemical and physiological behaviour from their stable parent elements.

(*b*) their radiations can be detected in a very sensitive way with geiger or scintillation counters.

Metabolic studies

The commonest application of this kind is the use of iodine 131 for the assessment of thyroid function.

The body contains about 30 mg of iodine of which 40-50% is normally found in the thyroid gland. The mass of the gland is about 20 gm (= 0.03% of the body weight) and the clinical uses of radioactive iodine depend largely on its singular power of concentration, not found with any other element in any other organ or tissue.


Inorganic iodine administered.
Thyroxine decomposed into inorganic iodine which returns to plasma
Inorganic iodine in plasma, some removed by thyroid and some by kidneys
Inorganic iodine in kidneys
Thyroxine passes from plasma into other tissues
Inorganic iodine in thyroid converted to thyroxine
Excreted in urine
Thyroxine circulates in plasma protein

The Iodine Cycle.

Therapeutic applications

The only isotope widely used as an internal therapeutic agent is iodine 131 in thyrotoxicosis. A dose of 5-10 μc (according to the size of the gland) given by the mouth is usually successful in reducing the activity of the gland to an acceptable level. In many places it is reserved for those over 40 years of age for fear of the long term danger of inducing thyroid cancer. Phosphorus 32 is used for the treatment of polycythæmia vera, a rare disease characterised by excessive proliferation of the red cells in the blood. A single intravenous injection of 3-7 μc brings the red cell count to a reasonable level, temporarily or permanently.

Interstitial therapy with radioactive materials may be accomplished in two ways : (*a*) by implantation of radioactive pellets e.g. gold 198 to give a localised radiation treatment ; (*b*) radioactive fluids may be instilled into the bladder or other cavities for the relief of malignant disease.

Cancer—The treatment of malignant disease has not been significantly affected by the advent of radioactive isotopes. In thyroid carcinoma, a small proportion (15%) of cases respond well to massive doses of iodine 131 (100—150 μc). With these exceptions, it seems unlikely that internally administered radioactive materials will ever be able to destroy a tumour. The lethal dose of radiation for a tumour is about 6,000 r. and the greatest dose which can be given with equanimity to the rest of the body is 100 r.

Terms used in radiation

Curie—the unit of quantity of radioactive material, that is, the amount of radioactive material in which 3.7×10^{10} disentegrations take place per sec. Since the curie is a very big measure the micro-curie level is used for human purposes. The micro-curie (μc) is one/millionth of a curie.

Rad—the unit of absorbed dose and is 100 ergs/gm.

Roentgen—also used as a unit of radiation dose. It is defined as a unit of exposure dose as against absorbed dose.

RADIATION HAZARDS AND THEIR CONTROL.

Radiation hazards are as old as radiation itself. There is no reliable evidence for any threshold effect in radiation injury, either in the human organism or in any other. Therefore, it must be presumed that all radiation is harmful. The so-called tolerance dose should be regarded as a useful index for the supervision and

appraisal of a radiation safety programme. It does not have the biological significance that its name suggests.

The history of the radiation hazard may be viewed in four stages of time. (Lenihan, 1959).

1. (1895—1920) :—X-rays and radium were used with careless enthusiasm and little regard for possible dangers.
2. (1920—1935) :—Administrative and technical action was begun with the object of controlling the radiation hazard.
3. (1935—1950) :—Radiation work was apparently made safe by improvements in apparatus, establishment of tolerance levels and close supervision of occupational exposure.
4. (1950—) :—Fresh dangers, affecting workers, patients and perhaps the whole human race, were identified.

Biological effects of radiation

The mechanism of radiation damage is a subject of which not enough is known to give a rational description. The effect of radiation on the cell results in two kinds of damage.

(*a*) *Somatic changes.*—Small doses of radiation tend to delay cells from dividing (mitosis). Their effect is more noticeable in cells undergoing mitosis rapidly. For this reason skin, bone marrow, testis and blood are among the most sensitive tissues to radiation. Nerve and muscle are relatively insensitive. Thus a malignant tumour growing rapidly will be more sensitive to radiotherapy. Larger doses of radiation cause mitosis to be delayed, but in addition, a number of degenerate cells appear. The bigger and the more quickly the dose is given the greater will be the number of degenerate cells. Chronic irradiation may be followed by malignant changes. Large doses effect partial destruction or disorganisation of the blood-forming tissues, with an increased incidence of leukæmia and aplastic anæmia in exposed subjects.

(*b*) *Genetic changes.*—Mankind has been subjected to a certain amount of irradiation from primeval times and it has been postulated that the very existence of man depends on gene mutations, caused by radiation, in the animal from which he evolved (Barnes and Taylor).

Human cells, apart from the reproductive cells, contain 46 chromosomes each of which is thought to contain some thousands

of genes. The reproductive cells each have 23 chromosomes, so that the fertilised ovum has 46, half of which come from the father and half from the mother. Both the nature of the individual genes and their arrangement in the chromosome have their effect on inherited characteristics. Under the influence of various stimuli, of which radiation is one, the make-up of one of the genes may be altered. So long as the cell lives this mutation or re-arrangement of the gene will be passed on to each daughter cell and all subsequent generations. The important genetic effect of radiation is, therefore, the production of additional gene mutations.

In a community regulated by natural selection, a modest increase in the mutation rate is of little concern because the harmful mutations will gradually be eliminated. In a civilised human community, such as ours, the physically and mentally handicapped are helped to survive into the reproductive period. Harmful mutations may therefore be retained in the genetic structure.

Genetic changes are of 2 kinds :

(*a*) *Dominant*—Where the gene change is dominant the defect is apparent in half the offspring, whether it is inherited from the mother or father.

If the gene change is present in both father and mother, it will be inherited by all their children. These are nearly all lethal in fœtal life and are one of the causes of abortion.

Father			Mother	
DN			NN	
DN	DN	NN	NN	

D=Dominant gene defect
N=Normal gene
Inherited characteristics from dominant gene of father

(*b*) *Recessive*—Most radiation-induced mutations are recessive in character and may therefore spread widely through the population before making themselves obvious. In order that a recessive gene mutation will be apparent in the offspring, it will be necessary for both parents to carry the mutated gene. It is possible, therefore, that the defect will not be shown for a few generations. If one of the parents is normal the defect will not be shown.

In the accompanying diagram where both parents have a recessive gene defect it is seen that one child will be normal (NN) and one abnormal (RR). Two children will carry one recessive gene each (NR) but will not show the defect and will resemble their parents.

Father		Mother
NR		NR
NN	NR NR	RR

N = Normal gene
R = Recessive defect of gene

Inherited characteristics from both parents with recessive genes.

Numerical assessment of the genetic hazard is difficult, but the following considerations are generally accepted at the present time.

(i) A substantial increase in the mutation rate above the natural level will probably damage the genetic structure of the human race.

(ii) Radiation is the principal source of induced mutations (as apart from those of natural occurrence). The ultimate effect depends on the total gonad dose delivered to the population, regardless of its distribution. The long term hazard is therefore estimated by finding the total gonad dose received by the irradiated group and dividing it among the whole populations.

(iii) A doubling of the natural radiation background will probably lead to a substantial increase in the mutation rate.

(iv) The natural background of radiation, from cosmic rays and local radioactivity is now about 3 r in 30 years.

(v) In Europe and North America the total dosage of genetically significant radiation may already have risen to twice the natural background. Almost the whole of this increase has resulted from the practice of diagnostic radiology.

Man-made radiation at the present time is mainly from :

(*a*) Diagnostic radiology—3-4 r in 30 years.

(*b*) Fall-out from bomb—0.1 r in 30 years.

Natural radiation from rocks, water, etc., is 3 r in 30 years. The maximum safe addition of man-made radiation to natural radiation may be about 5 r in 30 years. We are very near that figure now (3-4 r).

Gene mutations from radiation are 99% harmful. It is believed to take between 1,000 and 1,000,000 gene changes to make a genius ; hence their fewness. One gene mutation could produce an idiot.

DISPOSAL OF RADIOACTIVE WASTE.

Radioactive wastes are a by-product of nuclear energy, of weapon development, of therapeutic use of ionising radiations and of industrial and research processes. They are divided into solids,

liquids, and gases. Two main methods of disposal are commonly used :

(1) Storage, after it has been concentrated or reduced in size to save space.

(2) Dispersion, usually after dilution to permissible levels.

Both methods present many problems and no completely satisfactory method has yet been found. The solid radioactive waste from nuclear energy establishments is usually divided into combustible and non-combustible components and these are again segregated into high and low activity. The ash from combustible and high activity waste is disposed of, in concrete lined containers, at specified dumping sites in the sea. The amount which can be dumped is limited, since fish and seaweed show an increase in radioactivity which could irradiate the general public if dumping was not strictly controlled. Many of the radioisotopes used in medicine have a short half-life and are occasionally discharged into the sewage system. The level of radioactivity in the sewage where men are working is not allowed to exceed 0.1 micro-curie per c.c.

Disposal of radioactive waste with a long half-life presents many problems. An example is radium, which is a very toxic substance and has a half-life of 1,600 years. Burial is the main method used for long-acting radioactive wastes. In the luminising industry where the toxic radium is used the waste is incinerated before burial. This causes a light radioactive ash to be formed which may contaminate the surrounding air and cause an unnecessary hazard both to the workers and the general public. Burial in deep caves is not completely satisfactory since the archæologists may expose their discovery and irradiate the public.

Long-life liquid radioactive wastes may be stored in specially prepared tanks. The volume may be reduced by evaporation. The effluent is then diluted periodically and discharged in permissible doses. Short-life liquid radioactive wastes may be stored until decay has reduced its activity to an acceptable level. Gaseous radioactive wastes are mainly disposed of by discharging them in permissible doses through a high chimney stack into the surrounding air. A high chimney stack causes the gas to be more diluted with the surrounding air before reaching ground level.

Commentary

From the previous chapters it will be seen that radiation has increased considerably since the discovery of radioactivity 60 years ago. The natural background radiation has been present since

the beginning of man and presents no new hazard. The recent increase from fall-out of the atomic and hydrogen bombs, although receiving much publicity in the medical and public press, is not as hazardous as other man-made sources of radiation. These sources are mainly :

(*a*) Diagnostic radiology.

(*b*) Luminous watches and clocks.

(*c*) Indiscriminate use of shoe-fitting x-ray apparatus.

Diagnostic radiology is responsible for 3-4 r units in 30 years as opposed to 0.1 r units in 30 years for fall-out from atomic and hydrogen bombs. A recent Committee on Radiation Hazards has recommended that the routine x-ray of the pelvis in pregnancy should be stopped and used only where there is a specific reason. They also recommend the cessation of mass miniature radiography of school children and pregnant women. The radiation dose from a mass miniature radiographic film may be 5 or 10 times larger than that from a large sized x-ray film. Many patients insist on having x-rays where there is no urgent medical indication. These could probably be satisfied by the use of placebo x-rays. Unfortunately, the general public have become very x-ray conscious when they receive an injury at work in order to strengthen their claim against their firms.

The main danger from x-rays is the amount of radiation received by the gonads (reproductive organs). This hazard could be reduced by shielding the gonads of the patient with a lead cover and by directing the beam more accurately on the specified area to be x-rayed. Out-of-date x-ray apparatus should not be used. It is occasionally mentioned that radiologists themselves are often the hardest to convince that there are such things as radiation hazards.

The use of luminous paint from the toxic material radium for watches and clocks gives rise to radiation exposure to the following :

(1) The workers engaged in this industry, although they are well supervised, are in contact with the radioactive powder and dried paint which tend to spread over the luminising room.

(2) Radioactive waste is disposed of by burial at the factory after incineration to reduce the bulk.

Until recently, there was no strict legislation as to the methods of disposal.

The Radioactive Substances Bill 1959/60 has recently been announced by the London Ministry. This is a United Kingdom Bill to deal with the registration of users of radioactive materials

and for the safe disposal of radio-active waste.

(3) People using luminous clocks and watches receive an appreciable amount of radiation (Table 1). These articles may have served some useful purpose in years gone by when lighting facilities were poor, but their uses are now out-dated and they present an unnecessary radiation hazard.

Shoe-fitting x-ray apparatus has a doubtful place in the shoe shops to-day. Although the amount of radiation is small when properly used, they are, nevertheless, very often used under no medical supervision by people who know very little about their possible dangers.

Radiation is cumulative and there is no tolerance to it in humans. It may take several generations before we can assess genetic changes caused by radiation. A rational approach to this subject by all those concerned with man-made radiation would do much to keep the level of radioactivity well below the danger level.

There is much scope for educating the general public in this field.

The foregoing paper has been necessarily general. Many of the problems which have been discussed are those that will soon confront the local health committees and their staffs. It is hoped that a reading knowledge of this subject will be grasped and an incentive created to study this new field in greater detail.

I wish to record my thanks to Dr. J. M. A. Lenihan, Regional Physics Department, Glasgow, whose lectures, given during a course on Radiation Hazards, guided me in preparing this script ; to Dr. J. C. Paisley, County Medical Officer of Health, Armagh, Dr. R. I. G. Reid, Deputy M.O.H. and Dr. A. T. Elder, Deputy Chief Medical Officer, Ministry of Health, for valuable discussion and advice ; and to Miss M. Watson, who provided secretarial help.

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APPENDIX

Legislation

The use of radioactive substances is regulated by the following Acts.

1. *Radioactive Substances Act, 1952.*

This Act applies to the United Kingdom, not just Great Britain,

and under its provisions a committee was set up called the Radioactive Substances Advisory Committee on which Northern Ireland has representation. The responsible Ministry under the Act in Northern Ireland is the Ministry of Health and Local Government.

2. *The Atomic Energy Authority Act, 1954.*

This Act applies to the United Kingdom as a whole.

3. *Nuclear Installations (Licensing and Insurance) Act, 1959.*

This Act deals with the licensing of sites and nuclear installations with application to the United Kingdom. In Northern Ireland the responsible Ministry is the Ministry of Commerce, although technical advice will be furnished by the United Kingdom Atomic Energy Authority.

4. *Radioactive Substances Bill, 1959/60.*

This is a United Kingdom Bill to deal with the registration of users of radioactive materials and for the safe disposal of radioactive waste. The responsible authority in Northern Ireland will be the Ministry of Health and Local Government.

5. There are luminising regulations made under the Factories Act in Northern Ireland which have purely local application but are based on similar law operative in Great Britain.

6. *The Radiological Protection Service.*

This is an advisory bureau set up under the Ministry of Health and the Medical Research Council jointly to which Northern Ireland has access for advice at any time and to which such articles as monitoring badges are sent on a routine basis from Northern Ireland to act as a check on the safety of the individual operator.

7. *The Monitoring Service.*

Monitoring services, dealing with the safety of the environment as opposed to the safety of the individual, are in operation throughout the world and various committees exist at Government and local level. Northern Ireland is part of this general scheme and possesses its own committees, both at Government and at local level (university and hospitals). These committees are all linked so far as information and advice are concerned.

CLEAN AIR—BETTER HEALTH

A New Display

GIVEN imagination, time and talent (whether it is that of members of the health department or the local art school or technical college), it is possible to produce displays on a low budget, and often the simplest displays are the most effective.

From time to time, however, the local authority has the task of presenting a display in an exhibition consisting largely of professionally produced exhibits, to which a great deal of money and expert knowledge have been devoted. This is often the case with clean air exhibitions, and it is sometimes difficult for the public health department to compete with the excellent displays shown by the various organisations and companies concerned.

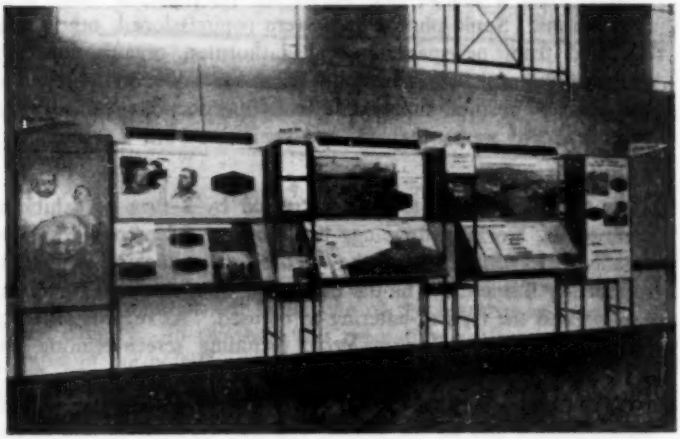
About a year ago a medical officer of health suggested to the Central Council for Health Education that there was a need for a good display dealing with air pollution entirely from the health point of view. This would complement the displays presented by other bodies, which play a very important part in putting over the "clean air" message but (not unnaturally) tend to stress the products of the companies concerned. The Central Council therefore decided to produce such a display and to make it available on loan to local authorities for use in their campaigns.

The display had to be easily transportable, and the space available would vary from area to area, so a flexible arrangement of panels mounted on metal frames seemed to be the most useful type of stand. In designing the basic structure the possibility of using the panels again at a later date and for a different subject was borne in mind. A rough plan was made of the type of stand required, and this was adapted and modified as work proceeded.

Research and scripting

Before any attempt was made to design the display considerable research was carried out. A number of publications were consulted, including the Beaver Report, the Clean Air Act and the "Family Doctor" booklet *Clean Air*. Advice was given by several authorities on the subject of air pollution and its effect on health. A long list of relevant facts was made, and these were sifted to

produce a rough outline of the proposed script. Further discussion followed, and the script was modified until a coherent story resulted. The message was directed towards the housewife, and showed how she could help to " clear the air ". The final script consisted of the exact wording for every title and caption in the display.



Visualising the theme

Various methods of effectively illustrating the story were considered, including the use of actual equipment and models. This was eventually rejected, since it was thought that the local authority would prefer to show the type of equipment used in its own area, and also to avoid damage to equipment in transit.

The first job of a display is to attract attention, and with this in mind it was decided to use on the first panel some good blown-up, cut-out photographs of the people most affected by air pollution and smog, i.e. those under 1 year and those over 65. The theme would be illustrated mainly by photographs, some arranged to stand away from the background to give a three-dimensional effect. Light and movement were introduced at certain points by means of (a) an illuminated box unit showing contrasted lung sections, and (b) a black and white transparency behind which a rotating lampshade produces the effect of smoke drifting over rooftops.

A detailed design was prepared, both for the stand structure and the individual panels, captions being treated as part of the design. Colours were planned, and to heighten the contrast between the

smoky and the clean areas, the large photograph of the smoky town was to be tinted blue and that of the clean area a sunny yellow. The display panels were to be mounted on metal " ladder units ", and some extra ladder units were to be made so that the display could be angled at any point to fit into the available space. Shelves were included for the display of hand-out leaflets.

Meanwhile a search had begun for photographs and other illustrations. Some photographs were commissioned, others were obtained from newspapers, local authorities, organisations and photographic agencies. In some cases reproduction fees had to be paid. A hospital supplied suitable lung sections, statistics and other material were obtained, and some art work was done.

Construction

As the display was to be constructed by a firm of exhibition contractors, working drawings had now to be prepared. These detailed everything, from the method of attaching panels to supporting framework, to the exact size of each photograph and caption and the type of lettering to be used. As regards lettering, several methods were considered, including screen-printing and photographed type-set captions. A more economic way, which was finally chosen, was to have the main headings and sub-headings screen-printed and all the smaller captions typewritten and photographed in reverse print (white lettering on black ground).

A scale model of the stand was made. This was not essential, but it was very helpful both in designing and constructing the stand and in presenting the idea to the appropriate committee. It gave a much clearer picture of the proportions of the finished stand than would a perspective drawing.

After many months of planning the display was now ready for construction ; quotations were obtained and the order was placed. There were a few consultations with the contractors and some minor technical modifications—and in a matter of weeks " Clean Air—Better Health " was ready to start its tour. The display was inaugurated by Sir Allen Daley at a ceremony at Camberwell.

It is hoped and believed that the display will prove a useful addition to Clean Air Exhibitions. It also forms a complete unit for showing in public libraries, town halls, and other places.

Application for the use of CLEAN AIR—BETTER HEALTH should be made to : The Exhibitions Assistant, Central Council for Health Education, Tavistock House, Tavistock Square, London, W.C.1. Borrowers are asked to pay a service charge of 10s. 6d. per week and cost of transport both ways.

SHEFFIELD'S CLEAN AIR CAMPAIGN

By F. St. D. ROWNTREE, Health Education Officer,
City of Sheffield.

From the time of the Industrial Revolution the city of Sheffield has had a reputation for being one of the blackest and smokiest in the country. In the main this reputation has been unjustified, as most of the pollution was centred around the industrial valleys and not evenly spread over the remainder of the city.

Since these early days of the 19th century and the growth of industrialisation, there has been great civic interest in reducing atmospheric pollution, particularly that from industrial sources. Newspapers of a hundred years ago carried numerous articles and news items on the subject. The continuous campaigning for clean air by progressive-minded citizens since then has created a positive attitude throughout the community towards the desirability of clean air and the eradication of atmospheric pollution.

Following the Clean Air Act, 1956, which gave new powers to local authorities, including the control of domestic chimneys, steps were taken to survey the city for the creation of smokeless zones. It was felt that a publicity campaign should precede the first of these which was to come into being on 1st December, 1959.

In June, 1959, the Health Education Service was created and its first task was the production of a clean air publicity campaign, whose objects would be to provide information on the causes and the effects of atmospheric pollution and the ways being used to combat them ; and to show the general public how they could co-operate in fighting pollution whether they lived in smokeless zones or not. As the campaign was to coincide with the commencement of the first smoke control zone the historic implications were also stressed.

Preliminary approaches were made to government departments, national organisations, voluntary bodies and other local authorities who had already undertaken clean air campaigns, with a view to gaining information or practical co-operation and support. The response was good and varied from offers of complete exhibition units to assistance with distribution of literature. The appraisal of the responses resulted in a decision to limit the exhibitors taking part in the exhibition to the public health department and the main fuel industries. The material from other agencies was used in subsidiary exhibitions and displays held in various parts of the city.

Local co-operation

A request for co-operation was sent to all chief officers of the Corporation departments, who responded by offering to display posters and distribute leaflets to the members of their staff. In certain instances assistance was extensive. For instance, the City Treasurer distributed leaflets to some 50,000 people attending the Rating Hall during the month of October, and this represented a fair proportion of families throughout the city.

The City Librarian displayed posters and supplied leaflets and book marks in all branch libraries. In addition, films on clean air were included in the cultural programmes given each month in the central library theatre.

A special effort was made with schools and educational establishments. The Director of Education arranged to circularise all head teachers. Posters and leaflets were supplied for use in schools. A special batch of literature was supplied on request to teachers interested in including references to clean air in their routine teaching. This included a Clean Air Year Book, science teachers' leaflets, background notes, graphs, historical material, lists of visual aids, etc. Science teachers and others interested were invited to visit the Health Education Centre to preview the available teaching materials. Opportunities for conducted tours over the exhibition were also offered.

The public health department carried the brunt of the propaganda campaign. All premises displayed publicity material. The subject of clean air was introduced into group health teaching in clinics and welfare centres and was also raised during home visits made by various members of the staff.

Secretaries of voluntary organisations throughout the city were asked to give support by displaying posters and distributing literature for the benefit of members. The response to this initial

contact was outstanding. Invitations were later sent to chairmen and secretaries of these organisations to attend the opening ceremonies. In addition a general notification of the events which were to take place was given to their members.

Press conference

The local press had taken a keen interest in the zoning programme which increased as the time of operation of the scheme came nearer. To gain maximum press support for the publicity campaign and to allow time to prepare feature material, a press conference was called a month before the inauguration of the main campaign. Representatives of local and national newspapers were invited. At the conference, information was given on the history of the problem of atmospheric pollution, the steps being taken to combat it and the proposals for the future. In addition to the verbal information, special data sheets containing general information, facts and figures, charts, etc., were provided for each newspaper editor. This information was extremely useful and assisted in the preparation of a number of feature articles. Time-tables of the arrangements of the inauguration ceremonies and opening of the exhibition were also provided to enable press cover arrangements to be made.

Publicity media

It was decided that evaluation of publicity material available from governmental departments and national organisations should be made before embarking on the production of costly, special literature. Adequate, suitable material was available and, with the exception of publicity giving the dates and times of the exhibition, this material was used.

Posters—Almost 4,000 posters were displayed in corporation departments, clubs, churches, industry, etc. In addition, 200 commercial poster sites were rented for a month. Mobile posters which gave details of the exhibition were displayed on vans, ambulances, buses, private cars, in shop windows and other public places.

Leaflets—Leaflets were used to build up public interest before the main campaign. First distribution commenced in late September and early October with the co-operation of the City Treasurer who supplied some 50,000 copies to rate-payers from homes throughout the city. Seven different leaflets were used in all and distribution continued up to and during the exhibition. A total of 125,000 leaflets and booklets were issued. This figure

does not include the material put out by the various fuel industries. Evaluation was carried out by the questioning of visitors to the exhibition and of other people in various parts of the city ; this showed that the different leaflets had been read and that the expenditure was worthwhile.

Films—Films were used throughout the exhibition. Film shows were also provided in the central library theatre and youth clubs, women's organisations, clinics, etc. During the exhibition single films were shown at half hourly intervals between 11 a.m. and 8 p.m. At certain times of the day, many visitors were children, but the over-all attendance was 75% adult.

Other activities

The shortness of time, did not allow for poster, essay and similar competitions or activities for schoolchildren and other members of the general public, particularly in view of the volume of administrative work required in arranging them. Lectures and demonstrations were offered to organisations throughout the city by the public health department and the fuel industries on the meaning of the Clean Air Act and methods of conversion of fire places and other appliances.

Staff

Professional, technical and administrative members of the health department staff were approached and asked to introduce clean air propaganda into their day-to-day work with the general public. They were also asked to undertake staffing of the exhibition. In view of the specialised nature of exhibition work and the subject matter involved, a short in-service training session for the officers concerned was arranged. During the meeting, information was given on the technical aspects by the Superintendent Smoke Inspector and on the health education techniques by the Health Education Officer. Printed literature and background notes were provided. The meeting concluded with a showing of films and other visual aids which were to be used throughout the campaign. The enthusiasm shown by all concerned was extremely gratifying and made possible the wide dispersal of publicity materials and information.

Inauguration of campaign

The low intensity campaign using the media and methods already described continued until mid-November when the climax was reached in the official inauguration of the major campaign and the opening of the exhibition.

Inaugural ceremonies

The Lord Mayor, Alderman A. V. Wolstenholme, J.P., kindly agreed that the inauguration should be a Civic occasion, to mark the importance of the event in the history of the City. The main ceremonies were preceded by a Civic luncheon held in the banqueting chamber of the Town Hall. Leaders of the political, religious, social and cultural life of the city were invited, in addition to the members of the health committee and representatives of the organisations most concerned with the clean air programme. The Guest of Honour was Dr. The Rt. Hon. Edith Summerskill, M.P., P.C. The luncheon concluded with the ceremony of cutting a clean air cake by Alderman Mrs. P. Sheard, Chairman of the Health Committee.

Following the Civic luncheon, inauguration of the campaign took place in the City Hall, and was attended by representatives of community and voluntary organisations throughout the city. The Lord Mayor took the Chair and before introducing the speakers, read telegrams of congratulation which had been received from the Mayor of Pittsburg, Pa., U.S.A. : The Minister of Housing and Local Government ; the Director of the Clean Air Society and the Chairman of the Central Council for Health Education. Dr. Edith Summerskill then gave the inaugural address, and other speeches were made by leading Civic dignitaries. The luncheon party was escorted to the exhibition site for the official opening.

Opening of the clean air exhibition

The opening of the exhibition was performed by a six-year-old girl in the care of the local authority. As the Civic party approached the entrance to the exhibition, the child stepped forward from inside the exhibition, cut a ribbon and at the same time said :—

" On behalf of the future citizens of Sheffield,
I declare the Clean Air Exhibition open ".

This unusual opening caught the imagination of the public and led to special radio and television coverage.

The exhibition took place in a marquee of 5,000 square feet. Space was equally allocated to the electricity, gas and solid smokeless fuel industries and the public health department. Visitors entered the marquee and proceeded in a clockwise direction, visiting first of all the health department stand, where they were given an opportunity of learning about atmospheric pollution—its causes and effects—before proceeding to the rest of the exhibition stands. Demonstrations showed the quantity and

types of local atmospheric pollution varying degrees of pollution on different types of day, grit slides showing fall-out, etc. Ways of measuring atmospheric pollution were shown on a demonstration unit loaned by the Department of Scientific and Industrial Research. Other material illustrated the effects of smoke, smog and pollution on stonework, fabrics, house furnishings, crops and human health. Illustrations showed reduction in smoke production of domestic and industrial fireplaces after conversion to approved appliances.

Further panels depicted ways and means of smoke control in industry. These were supplemented by aerial photographs which gave an airman's view of smoke over industrial South Yorkshire.

One of the most valuable exhibits was a large map showing the proposed smoke control zones with the expected dates of operation. This was displayed in a cubicle recess where members of the public had an opportunity of discussing conversions and other problems with trained members of the public health department staff.

The exhibits of the fuel industries showed how each organisation was contributing to national clean air and demonstrated the various types of appliances approved for domestic premises. These included open and closed fires, central heating systems, floor warming, panel heating, etc. Different methods of conversion were shown and the public could thus compare under one roof the variety of means available.

A smaller marquee for showing films was provided in addition to the main accommodation. Access was through the exhibition and shows were almost continuous during the whole course of the exhibition. Seating was provided for 35 persons, and generally speaking, two-thirds of this accommodation was occupied. A five-minute break at the end of every 25 minute film show ensured a changeover of audience.

The heating provided by gas and electric appliances being demonstrated was supplemented by a liquid gas air warmer of the type usually used for crop drying. This provided a comfortable and even temperature at low cost. Background music was supplied from gramophone records over a low power loudspeaker system.

Press coverage

In the weeks before the official inauguration, clean air and the forthcoming programme were increasingly mentioned in the local press. On the morning of the opening, feature articles—several pages in length—appeared in the local newspapers. The various editions of the evening publications carried news items,

and photographs, which fully covered the events of the day. Radio and television news services also reported the opening. Further publicity was given for the two weeks during which the exhibition was open by means of additional features—interviews with the Chairman of the Health Committee and members of the staff of the public health department, etc. The conclusion of the exhibition coincided with the commencement of the first Smoke Control Order, and was a further occasion for press publicity and comment on the exhibition and clean air in general.

Follow-up activities

The campaign described satisfied the aims already mentioned. It is very important, however, to continue a low intensity campaign until Smoke Control Orders affect the whole of the city, and the public are fully conversant with the part they must play. It is proposed that the low intensity campaign should make use of further pictorial and poster displays, leaflets, talks, discussions, film shows, etc. As new zones are scheduled, the intensity of the campaign will be increased within the specific locality for six months prior to the appointed day, with a view to hastening the process of conversion of domestic appliances. Smaller exhibitions of one or two days duration will be held. Lectures will be provided and mobile display vans of the fuel suppliers will tour the streets.

Evaluation of campaign and general conclusions

It is often difficult to assess the value of a campaign of the type described other than by the change in attitudes and behaviour of the general public.

All too often the figures of visual material distributed or numbers of visitors entering exhibitions are the criteria of achievement. These, of course, cannot be accepted as scientific evidence of success or failure. Evaluation in this instance was carried out by means of questionnaires given to the public. The questioning took place in various localities throughout the city and at the exhibition. Initially, the general attitude to conversion of household appliances had been one of apathy or mild hostility. There had been criticisms on the grounds of personal expenditure or because of erroneous ideas—for instance, that open fires would be banned or that the approved fuels were more expensive and difficult to burn. As the campaign proceeded, particularly during the time of the exhibition, there was a distinct change in favour of conversion of household appliances. An analysis of the questions asked of

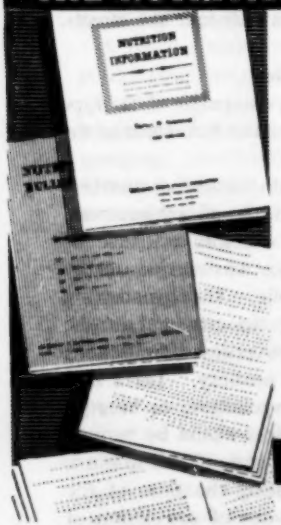
members of the staff at the exhibition showed that more than 75% of people wanted to know when their area could become a smokeless zone. This was also asked by the public in various parts of the city who were questioned in their own locale.

Suppliers of smokeless, domestic appliances and fuels said that there had been a very sharp rise in the sale of approved appliances and requests for information concerning conversion, and that undoubtedly the clean air propaganda drive had been responsible for the increase in demand.

In general it is considered that the campaign achieved the objects originally laid down, largely as a result of the all-round nature of the propaganda media used and the close liaison and co-operation of the professional, technical and administrative staffs of the organisations concerned.

I am grateful to Dr. Llewelyn Roberts, Medical Officer of Health of Sheffield, for his permission to publish this article and for his continuous sympathetic support and encouragement during the course of the campaign.

THE NUTRITION INFORMATION CENTRE



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IS HEALTH MORE IMPORTANT THAN CAMELS?

By AMIN KHALIL, Health Educator from Jordan ; formerly Lecturer in Health Education at the Institute of Sanitarians and Health Assistants of Benghazi, Libya.

WHATEVER definition is given to education it should imply the stimulation of the human mind to think independently within the limits of correctly established facts and then to make a free choice of action where action is required.

This is not an easy task, however. It is a difficult and perhaps a most delicate one. To avoid the difficulty many educators try a short-cut, and say what *they* believe and what people *should* believe. By doing this they are in fact expressing themselves. Very little can result, because education in its true sense is not a matter of self-expression ; it is a service rendered to individuals and groups and we should always try to make this service of benefit to those being taught.

As educators we tend to believe that our job is to teach people. Often we use the word " teach " where we really mean " preach ". We want to teach people ; instead we preach at them, not realising that preaching is not really teaching. If we get no response, or very little, it suits us to say that people are resistant and ignorant. I will return to this matter of resistance and ignorance later, but first I would like to mention the fact that people may often learn more from one another than they learn from any specialist. In some sense they teach each other and it is our job—as the educators——to help them teach one another.

In this sense most people are to some extent educators. It is perhaps enough to mention the fact that parents are educators in the real sense. So when we deal with people we should always bear in mind that we are dealing with educators and educators-to-be. Our fundamental aim is to help them to educate.

Why ignorant ?

The problem of teaching people the principles of good health does not lie only with the people. It also lies with us, the educators. We have talked too much for too long about people's resistance and ignorance. We have talked very little about the educators' ignorance. In some situations we prove to be ignorant too. Yes, we know a good deal of health facts, but our ignorance lies in the sphere of transmitting these facts to people in a way acceptable to them—it is in the matter of understanding people that we sometimes prove ignorant. It becomes even worse when we couple this with ignoring the real meaning and aim of education. We sometimes fail to grasp the real meaning of education, and therefore we fail to do good educational work. Not realising this, we find it easier to put the blame on the other side—the people—and we find it convenient to convict them of resistance, or charge them with the traditional accusation of " ignorance ".

From the educational point of view I do not think that ignorant people exist in this strict sense. The bedouin who roves the Arabian desert on his camel does not know as much as I know about health, but I know nothing about rearing camels and he knows all about it. Why then should I accuse him of being ignorant ? Because my mode of life is better than his ? How can I prove it ? It may be said that health is more important than rearing camels. Probably it is, but if we stick to the idea that health is more important, or the most important thing in life, we will not be able to educate. If this is our attitude what service are we doing to people ? We are merely expressing ourselves, and this is of no use to them. It is wrong to regard people as ignorant. It would be better to accuse them of being resistant. This is not an accusation, it is a fact. But we forget that we too are resistant. If a bedouin wants to teach me one of his ideas about health which, according to my belief, is wrong, will I accept it ? Should I therefore, when teaching him, expect him to be anything but resistant to my ideas ?

Resistance is not a bad quality ; it is a normal one. People find it difficult to change their beliefs and behaviour because their beliefs give them some degree of security, and their behaviour ensures group acceptance. So when people resist, it is not because they do not really want to change, but because they are afraid of losing their feeling of security, or are afraid of being rejected by the group.

The educator should understand this when he wants people to

replace an old idea by a new one. Before introducing a new one, he must have a better understanding of this old one, how it fits into the whole net of life, what type of security it provides. He must ask himself how the new idea can fit into people's life ; how it can provide a similar feeling of security. If the idea he wants to put across to them can provide the emotional security it will be good ; if it can provide a stronger feeling of security it will be much the better. The feeling of security which we tend to ignore is very important. We know, for instance, that in the distant past people worshipped idols because this gave them the security they needed ; but when the great religions of Christianity and then Islam came and made them know God, people changed because knowing God gave them a stronger feeling of security. So if we want people to adopt new ideas and beliefs the importance of a feeling of security should not be overlooked. Resistance can be smoothed and overcome if the educators apply enough skill.

If we approach people with the idea that we are going to teach ignoramuses we probably can do very little. When we approach them with the additional intention of learning from them we can do much better. In tackling any health problem we may assume that people are not aware of certain aspects of it, and we should find out what these aspects are. We cannot find out without listening to them and learning from them. I remember when I started my career in health education I met a group of leaders of a semi-primitive community for the purpose of discussing a specific health problem. I had the ideas which I wanted to convey to them well listed in my mind. When we started talking about the problem I found that some of my ideas were out of place, and so could not put them over. However I was struck with a brilliant idea that emerged from them, which offered a satisfactory solution. I considered that meeting very successful not only because they felt that the solution was theirs, but also because the solution was a by-product of the discussion in which I had been involved. This made me realise that if the educator insists that people are ignorant, he is doing no more than putting barriers between them and himself.

The so-called educated

In my experience in health education work in the Middle East I have come to realise that so-called educated people are the more difficult to deal with. It has been very difficult to introduce health education into schools. The teachers were not willing. If the

school's job is to prepare children for life, why should the teachers be resistant to health education which makes an important contribution to this preparation? I am not pointing out the reasons for the teachers' unwillingness, but merely trying to stress that part of our problem in education to-day is to re-educate the so-called educated.

Another gap

Turning back to ourselves as health educators, what other gaps do we face? Health education is often said to be still in its infancy. But what health education are we talking about? Are we talking about health education programmes in the different countries of the world? or are we talking about our knowledge in the field of health education science? When we carry out programmes in the field of health education we definitely gain experience and new knowledge. If health education programmes in most countries are not yet—in quality and quantity—as we wish them to be, this does not mean that we do not know the techniques. In fact our theoretical knowledge is good, but the application of this knowledge lags far behind. We health educators are partly responsible. We have committed errors in spite of our sincere efforts. If there was no harm in committing these errors at the beginning, there will be a lot of harm if we continue to commit them. We are now required to bridge the gap between our theoretical knowledge and its practical application. Those of us who work in countries where no systematic health education was carried on before should make a good start by benefiting from the experiences of our fellows in countries which have already gone farther. All of us should gain deep insight into the real meaning of education, particularly when it is health education.

Health education is a science and an art. This statement can hardly be justified if the whole matter is just to spread knowledge. At times, some such words as "propaganda", "information", "education", confuse us to the extent that we use one when we mean the other. Sometimes we use "education" where we should use "indoctrination". Education helps the mind to grow. Indoctrination enslaves the human mind, it works against education rather than for it. It is not wise to indoctrinate in order to teach; and one of our duties as educators is to protect minds from being enslaved. We aim to develop the intellectual capacity to its utmost fulfilment. The minds of those we intend to teach must work in order to grow and develop, and that is why education must necessarily be an active process.

HEALTH EDUCATION— A MULTI-DISCIPLINARY APPROACH*

By RICHARD G. BOND, M.S., M.P.H., Hon. F.R.S.H., Professor, School of Public Health; and Public Health Engineer, University Health Service, University of Minnesota.

More than one hundred years ago in the United States, Lemuel Shattuck prepared his Report of the Sanitary Commission of Massachusetts. Included in the Report are some fifty specific recommendations relating to the establishment of a public health programme for the State of Massachusetts. In addition to provisions for the creation of a State Board of Health, the keeping of vital statistics, and the reporting and control of communicable diseases, there are several recommendations that refer rather specifically to health education. Among these are the following[1].

> " We recommend that local Boards of Health endeavour to carry into effect all their orders and regulations in a conciliatory manner; and that they resort to compulsory process only when the public good requires it ".

Shattuck here recognised the necessity of favourable opinion and co-operation of the public. Further, he seems to recognise the dual functions of health information and health education when he writes that, " Boards of Health should *diffuse information* concerning their regulations, and the measures they propose for execution; and public opinion *should be educated* and properly influenced in their favour ".

In another section of the report relating to recommended social and personal measures, Shattuck recommended that a sanitary association be formed in every city and town in the State for the

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purpose of collecting and diffusing information relating to public and personal health. Shattuck wrote, " public opinion needs to be educated, and in no way can it be more effectually done than by associated effort. "

Apparently not one to miss any opportunity for health education, Shattuck also recommended that " clergymen of all religious denominations make public health the subject of one or more discourses annually before their congregations ".

Shattuck undoubtedly received much inspiration from Edwin Chadwick and others in England who were responsible for the very beginning of public health as we think of it to-day. Like Chadwick, Shattuck was not a physician. He was a school teacher, and later a bookseller and publisher. He was a student of history and genealogy, which led to his interest in statistics and resulted in the recommendation for a census of the population, and the registration of births, deaths and marriages.

He was, at all times, an advocate for the betterment of personal and community health by means of health education. To-day, 110 years later, we are gathered here to discuss, and to advocate I presume, similar goals for health education.

Definition of Health Education

In attempting to define " health education ", it is apparent the term has many different meanings depending upon the different persons concerned with health education and their particular health problems of the moment.

For the parent concerned that his child brush his teeth twice a day, health education is very direct, with considerable reliance on parental persuasion. For the same dental health problem, this child's dentist might have a different health education approach which would be fortified considerably if timed with the response to the dental drill.

The patient consulting his family physician for medical care is also receiving health education. His educational experience may or may not be helpful in terms of future health practices, depending on the relationship established between the physician and patient.

In the schools, health education may be formal and impersonal. The prescribed health information dispensed by the teacher is accepted by the pupil, unfortunately, all too often without understanding and without personal acceptance or application. For the school boy, personal health information may have a vastly

different importance if introduced in the spirit of athletic competition as contrasted to a classroom and textbook approach.

For the public, health education may be the product of a sales promotion and advertising " pitch ". In the United States to-day, television commercials seem to the writer to a large extent to be advertisements of cure-all pills or such for all manner of symptoms.

Among the members of the public health team, the practice of health education takes on different forms and has different meanings for each of the several categories of specialisation. It is generally agreed that public health practice is predominently of an educational nature, although in the actual performance of duties, the physician, the public health nurse, the engineer and the sanitarian all too often fall back on the jargon of their technical speciality without recognising that these are frequently more of a crutch than an effective tool in trying to accomplish the health education task at hand.

For the professional public health educator, health education is a field of specialisation involving skills and knowledge not normally available to others working in public health. Just as for the others, health education has special meaning for these specialists, and it is not my intention to attempt to discuss health education from the health educator's point of view.

For the purpose of this paper, I would like to consider two aspects of health education : one, the integration of health education concepts into the professional education of public health workers ; and two, the implementation of health education into all aspects of public health practice. The first of these can be illustrated by the example of graduate schools of public health in the U.S.A. ; more specifically, if I may, I would like to discuss the curriculum of the School of Public Health at the University of Minnesota. Regarding the implementation of these health education concepts into public health practice, I would like to use the clinical and public health setting provided by the University of Minnesota Health Service as an illustration.

Academic preparation for health education

The School of Public Health at the University of Minnesota is one of thirteen such schools, ten in the United States, two in Canada, and one in Puerto Rico, accredited by the American Public Health Association for work leading to the post graduate degrees of Master of Public Health or its equivalent[2]. At the University of Minnesota, the School of Public Health offers a wide range of both

general and professional courses in the field of preventive medicine and public health[3]. The general courses are designed for University students requiring knowledge of personal health and an understanding of community programmes for the promotion of public health. All personal and community health courses offered throughout the University are taught by the faculty of the School of Public Health. Such courses are found in the curricula of the College of Literature, Science and the Arts, the Institute of Technology, the College of Agriculture, the College of Medical Sciences, and the College of Education. These courses are specially designed for the particular needs of the student. For example, in the College of Education, students preparing to teach in the public schools are required to have courses especially relating to the health problems of school-age children.

In the College of Medical Sciences, courses in preventive medicine for medical students are taught by the faculty of the School of Public Health.

Professional training courses which lead to the graduate degree in public health are offered to all professional public health categories including physicians, statisticians, public health nurses, public health engineers and sanitarians, health educators, hospital administrators, public health veterinarians, and from time to time, professional personnel who are preparing for positions as public health dentists or public health nutritionists.

The curriculum for all specialties has as its core six basic courses ; these are public health administration, epidemiology, statistics, environmental sanitation, public health nursing, and health education. During the past two years, the basic six have been integrated into a year-long course required of all graduate degree candidates. Units covering maternal and child health, medical economics, hospital administration and mental hygiene have now been incorporated. This course emphasises training of a co-ordinated team of professional workers each member of which has understanding and appreciation of the contributions which each of the specialties makes to the broad field of public health.

Our philosophy of education in public health is that if public health personnel are to work together, then in their professional training it is beneficial that they study together as a team. In practice, the soundness of this concept is demonstrated time after time as we observe during the course of the academic year the manner in which students grow in the sharing of experiences, viewpoints and knowledge, and respect for each other's contribution.

The committee project required of all students in the health education unit of the required integrated course is an example of the interdisciplinary approach to health education provided in the School of Public Health.

In the middle of the school year the class of approximately 120 graduate students is divided into ten committees each of which is assigned a topic representative of current public health problems and practices. The topics assigned during each of the past two years include the following :

1. Prevention of home accidents.
2. Community cardiovascular programme.
3. Prevention of perinatal casualties.
4. Community medical care programme.
5. Mental health—follow-up of hospital discharges.
6. School lunch programmes.
7. Suburban living.
8. Control of staphylococcal infections in hospitals.
9. Gastro-intestinal infections in tropical areas.
10. International health.

In assigning students to these topics, care is taken so that all of the public health specialties available in the student body are distributed more or less evenly throughout the ten committees. Not only is selection made by specialties, but consideration is given to providing as broad a geographical distribution as possible. Students from overseas are selected so that two students from the same country are not assigned to the same committee. Consideration is given also to geographical distribution from the United States, so that public health experience from east, west, north and south is shared in the committee work.

Two or more faculty members are assigned to each committee with due regard to the specialties each represents and their maximum contribution as a resource person to the committee.

As a public health engineer, I have twice had the opportunity to be a resource person to the committee working on the problem of suburban living. My colleague, Dr. Ruth Grout, Professor of Public Health Education, has served as the other faculty representative for this committee.

Brief reference to the composition of our student committee for this year is illustrative of the organisation and representation which have been described. The committee elected a Chairman, whose basic training and work experience has been in the field of medical technology. The Recorder of the committee is a public health

nurse. Other members are from sanitation, hospital administration, public health veterinary medicine, health education, public health engineering and public health nursing. This year the public health engineer is a student from India, one of the public health nurses is from Brazil and the third nurse on the committee is from the Philippine Islands.

The statement of the problem which is supplied to the committee is based on an actual situation ; in this case the public health problems of suburban living for a community near the city of Minneapolis. This selection of an existing community gives reality to the problem, and permits the students to grapple with all the frustrations of actual public health problems.

In the statement, the committee is given the name of the community, its location, population and its socio-economic characteristics in very superficial terms. The population in this instance is chiefly " white collar workers " employed in Minneapolis. The community has the usual church and civic groups and voluntary associations. The students are expected to develop all the other basic information they consider necessary for complete definition of the problem. This usually requires study of the most recent census data for characteristics of the population ; study of topographic, area, and highway maps to learn relationships with other population centres ; and a careful review of reports of health and municipal agencies including newspaper coverage of the health problems of the community being studied. They are encouraged to meet and interview the editor of the local newspaper, civic leaders, leaders of voluntary organisations, and health officials at state and local levels of government. It is emphasised that the students " dig out " these sources of information on their own. One of the basic values of the exercise is the necessity on the part of the student to make decisions and follow through on his own responsibility.

The students have as their assignment the solution of how this community can solve the immediate problem of providing adequate water and sewerage facilities, and how it can provide or secure other essential health facilities.

Three specific questions are asked as a basis for guiding their initial exploratory efforts : (1) the committee is asked to describe the full extent of the problem of water supply and waste disposal, and the inter-related problems of zoning and building regulations in the community ; (2) to discuss other health problems likely to be present in this developing suburban community ; and (3) to

outline a feasible plan for community action not only for the immediate environmental sanitation problems, but as a proposal for a long term programme for meeting community health needs.

With this assignment, the committee is put on its own to work out an organisation and plan of attack. In the beginning, each specialty tends to think in its own isolated frame of reference, and for one or two meetings committee action is most disjointed, to describe it mildly. The specialties express impatience with each other and attach widely varying degrees of importance to various aspects of the problem, but within a short time, a cohesiveness begins to appear and soon assignments are defined and usable data begin to accumulate as background information for ultimate solution of the problem. The hospital administration students tend to assume responsibility for securing information on community administration and frequently show interest in public health legislation at both state and local level. The physicians contribute their own special " know-how " in morbidity and mortality data. The health educator, of course, tends to draw attention to the necessity for information on community organisation, the presence or lack of civic groups, the role of the schools, parent/teacher associations, etc., in solving the problem. The public health engineer and sanitarian at first see the problem only as one involving principles of environmental sanitation, but they, too, soon broaden their horizon and compile information on population trends, economic levels, newspaper coverage of health problems over the past few years, etc. Similarly the public health nurses at first see this as a problem in nursing services but this soon expands to availability of clinics, school health services, etc.

Finally the students decide that basically the project is one involving evaluation of community resources and health education of the public. After many meetings, the members of the committee develop a plan for community action and in the process have also developed an appreciation for the value of a multi-disciplinary approach to a problem in health education.

Throughout the project the resource persons have remained in the background as much as possible, entering the discussion or giving suggestions when requested to do so, and, in essence, making every effort to have the students find their own way by overcoming their inexperience, their frustration, their discouragement and even antagonisms at times.

The final test, of course, is the committee presentation to the student body and faculty, with the opportunity for questioning

and criticism by the entire group.

Reference has been made to the requirement that students in the School of Public Health, regardless of their field of specialisation, must prepare for six basis public health courses offered as a year long sequence ; namely, administration, epidemiology, statistics, sanitation, nursing, and health education. At this point it should be emphasised that further course work in a " related field " is considered necessary in many instances. For example, our *undergraduate* students in public health nursing are required to register for a full course in environmental sanitation which has been designed especially to fit their needs, not as sanitarians obviously, but as public health nurses. Experience has shown that fundamental knowledge about the principles of sanitary science is an essential part of their basic training if they are to function most effectively in dealing with personal and community health problems. It is our opinion that the public health nurse must be especially cognisant of the physical environment and its public health implications. The examples of the health education opportunities which arise in this one aspect of public health are numerous and self-evident.

In similar manner, students in hospital administration are required to register for a full course in sanitation ; one that has been designed with due regard for the environmental health problems of the modern hospital.

Conversely, the several categories in public health often require more than the basic course in the principles and techniques of health education. This is especially true for the student preparing as a sanitarian. Such students are encouraged and often required to register for one or more additional courses in health education. Not only is this a need for the student who will be working in the U.S., but very likely is much more important for the overseas student who will be returning home to organise and carry out sanitation programmes in rural areas, and native villages, and to train others to do this kind of work. Training of locally recruited personnel to carry on public health programmes in tropical rural areas has been described by Chanlett and Wagner, for example, for the Amazon River Basin [4].

These are times of rapid technological development. New developments pose new problems, and the education and training of public health workers must keep abreast. This problem in health education has been strikingly emphasised in a report of the World Health Organisation on Post Graduate Training in the

Public Health Aspects of Nuclear Energy[5].

Early in the report, attention is directed to the public health aspects of nuclear energy, and the responsibilities of health personnel. The obligations and duties of health officers, hospital administrators, industrial hygienists, engineers and laboratory personnel are outlined. In addition, the report advises that " all public health workers have a common function to fulfil in relation to the general public—namely, to represent an authentic source of factual information on health matters, in this case on the health implications of atomic energy. Included in this category of worker, in addition to those already mentioned, are public health nurses, health educators, mental hygienists, social workers, etc., whose task it will be to alleviate and dispel public anxiety regarding atomic energy ".

The report then describes several levels of course work in nuclear energy for public health workers. The first of these is a so-called orientation course described as follows : " The orientation course might be considered as a basic universal course for most public health personnel—i.e., medical, dental, and veterinary personnel having no responsibility with regard to radiation ; public health and industrial nurses ; health educators ; hospital administrators ; sanitary inspectors ".

Apparently, in considering a multi-disciplinary approach to health education even a subject as new and as technical as nuclear energy falls within the scope of our interests.

A clinical and public health setting for health education

A multi-disciplinary approach to health education is illustrated in the clinical and public health setting provided by the Health Service at the University of Minnesota. The Health Service provides a dual but integrated service of day by day medical care, and at the same time serves as the officially designated public health department for the University. The latter responsibility is unique, but arises from the fact that the University is normally exempted from the public health programmes of the politically incorporated cities in which its several campuses are situated. Consequently, it has need for its own public health department in addition to a programme of clinical and hospital care for students and to a lesser extent for staff personnel.

The functions of the Health Service are : (1) to assure students and faculty members a healthy environment in which to live and work ; (2) to protect the health of the students attending the

University ; (3) to teach students the value of preventive and curative medicine through individual and formal health counselling. Although not administratively attached, the Health Service enjoys close working relationships with the Medical School and medical staff of the University Hospitals and many of the staff members serve on the faculty of the School of Public Health.

The Health Service works closely with many departments of the University and, without destroying the confidential patient-physician relationship, Health Service physicians can interpret to faculty members concerned with educational counselling of students any health problems which need to be taken into consideration in making educational plans for the student.

The staff of the Health Service consists of a director, two assistant directors, 18 full-time physicians, 3 of whom are psychiatrists, a public health engineer, a safety engineer, an industrial health engineer, 3 health physicists, a health educator, a public health nurse and 50 part-time physicians. In addition, there are 15 part-time dentists, a dietician, 2 psychiatric social workers, 1 clinical psychologist, 3 public health sanitarians and the necessary staff of clinic and hospital nurses.

A major health education activity is the programme of health counselling and medical care of students. A very thorough and complete medical examination is given each student upon his entrance to the University. This includes a dental examination, vision and hearing testing, and various immunisation procedures. Working together, the health educator and examining physicians have made the physical examination an experience in health education for the student. Following the initial examinations a counselling conference with a physician is scheduled for each student. At this time any physical or emotional deviations found at the time of the examination are discussed, and the student is encouraged to ask any questions he has regarding the examination and his own physical health.

All students are encouraged to have annual physical examinations. This is required in the colleges of medicine, dentistry, nursing and education ; in the other colleges it is recommended. It is hoped that through periodic health examinations, students will learn the value of such examinations as health insurance and as a basis for healthful living.

The out-patient department of the Health Service provides emergency medical care on a 24 hour basis. Consultations with specialists are available whenever needed. Students are encouraged

to report to the clinic for minor illnesses, in the belief that more serious illness can be prevented and that a concept of positive health may be developed through this practice.

Psychiatric care for emotional problems is offered the student in the mental hygiene unit of the Health Service. This is considered an extremely important part of the Health Service programme. The majority of students seen in the mental hygiene department are referred by the physicians in the medical out-patient clinic, many others are referred by the University's counselling bureau, and to an increasing extent students are voluntarily seeking help for their mental hygiene problems.

In the clinical setting there are many health education opportunities, particularly in communicable disease control. Immunisations against smallpox, diphtheria, tetanus, poliomyelitis and typhoid fever are available to all students but are not required. There is a continuing programme of encouraging voluntary participation in the various immunisation programmes both by the clinical physicians and the health educator working through the informational media of the University.

The health educator employed by the Health Service works with professional staff on educational activities in this programme and also with student groups and Counselling Services.

The services of the Health Service are extended to faculty and employees as well as the students ; they include, as well as medical, an environmental health and safety programme which endeavours to provide a healthful setting for the educational pursuits of the University.

With a setting such as has been described, there are countless opportunities for interdisciplinary health education efforts. There is the obvious opportunity for health education by the clinical physician during the patient visit ; the Health Service physicians are increasingly aware of this opportunity and are taking advantage of it even though it requires extra time and effort. Similarly, health education opportunities exist between the clinical nurses and the patients. The health educator has an opportunity to be a party to these relationships and to help the professional staff to make the most of their educational activities.

An interdisciplinary relationship which is of particular interest to me and which is rather unique, is that which exists between the specialists in our Division of Environmental Health and Safety and the clinical physicians of the Health Service[6].

In most clinics or dispensaries, physicians are treating patients

who are ill or have received injuries. All too often this is the beginning and the end of their association with any particular health problem. In the University of Minnesota Health Service, the physicians have an opportunity to prevent recurrence of certain illnesses and injuries. This opportunity is best illustrated, perhaps, by the approach that is taken to the problem of accidental injuries. In this case, the injured student reports to the dispensary desk for emergency first aid. The nurse determines the nature of his medical problem, and if the student is able, he is asked to fill out a brief " accident report form " supplying information as to the time and place of the accident, the activity in which he was involved (e.g. athletic, shop, laboratory etc.) and a brief description of the accident. At the top of the report form there is a brief explanation to the student to the effect that " completion of the form will allow the University to direct intelligently its efforts toward elimination of conditions and procedures that produce students' injuries ".

The completed form is taken by the student to the doctor who reviews the information supplied by the student, and completes the form by adding his diagnosis and treatment. Up to this point, both the student and doctor have, we believe, given much more thought to the circumstances causing the accident than they would have done had no reporting been necessary.

Promptly on completion the report goes to the safety engineer, who is a member of the staff of the Division of Environmental Health in the Health Service. If indicated, the engineer may confer with the doctor and even with the student in the event of a serious or unusual accident. In any case an investigation of the site of the accident follows, if the accident is of a type amenable to correction.

All along the line, the student, physician and safety engineer are contributing toward prevention of recurrences of accidents and probably getting some health education as they do so.

Similar co-operative relationships exist between physicians and sanitarians, the occupational health engineer, and the newest member of the public health team, the health physicist.

Conclusion

The first report of the Expert Committee on Health Education of the Public of the World Health Organisation, (April 5th, 1954) devotes two short sections to the concepts that are meant to be the theme of this paper. Section 7.11 is titled *Team Work*. Section 7.12 *Health Personnel as Education Workers*[7].

Though brief, these sections summarise much of what I would leave with you in discussing a multidisciplinary approach to health education. On the subject of "team work", the committee wrote, "effective health education requires close teamwork among the many categories of health and education personnel. Such teamwork implies the planning and organisation of health education programmes, so that *each* person accepts responsibility for that part of the programme he can do best, and carries out his part in such a manner that it supports the work of all the other personnel".

On the matter of health personnel as education workers, the committee wrote, "it is essential that all health workers be trained to make the best possible use of all health education opportunities and to possess both knowledge and skills in the use of educational methods, approaches and media. In this respect particular attention is drawn to the important role of physicians, nurses, medical-social and social workers, environmental sanitation, personnel, nutritionists, midwives, teachers and other education workers".

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BOOKS

DOCTORS' COMMONS—A Short History of the British Medical Association, by Paul Vaughan. (Heinemann, 1959. Pp. 254. Price 18s.)

In ten chapters, this eminently readable book describes the evolution of the British Medical Association from a small meeting of doctors convened in 1832 by a Worcestershire physician to the powerful organisation that to-day can install a Royal President in the Great Hall of B.M.A. House, designed by Lutyens in Bloomsbury.

In his writing, Paul Vaughan has achieved that delightfully unbiased balance he attributes to Dawson Williams, the Editor of the Journal during the greatest period of growth in the Association's history. He has done full justice to the activities of the B.M.A., in the advancement of medical science and in maintaining the honour and interests of the medical profession, while through it all, we are shown a pattern of constant effort to stimulate the public conscience towards an improvement in the health of the community. The steps to secure the reform of the Army Medical Services, the Six Cardinal (1911) and Seven Basic (1948) Points, Spens, Danckwerts and the Royal Commissions are faithfully dealt with in simple language, as are the evils of quackery and of smoke pollution, child health and the Special Reports. It is perhaps in his word pictures of the many diverse personalities who took part in this saga that the author excels.

In short, here is a work to be enjoyed by doctor and layman alike and one that should find a secure place on the bookshelf of the social historian.

W. H. P. MINTO.

THE JUNIOR TRUE BOOK OF HEALTH, by Olive V. Haynes, with pictures by Mary Gehr. (Frederick Muller. 1959. Pp. 47. Price 8s. 6d.)

It is difficult to see for what age of child this book is intended or in what circumstances it could be used.

The pictures seem the type enjoyed by 4-5 year olds. The text is suitable for the early reading of about 7 years (though its relation to the pictures is sometimes misleading). The related set of concepts is more appropriate for 8-9 years but lacks the technical information necessary at this stage.

Good health habits and simple rules of safety are expressed as a series of analogies. The number of analogies used is confusing; the underlying analogy of the body to a house is a false start, and to liken the dentist's care to patching a chimney seems ridiculous.

This is a misleading book, where well-founded ideas are treated in an ill-conceived way.

J. SHANNON.

STREETWALKER, by an anonymous author. (The Bodley Head. 1959. Pp. 191. Price 12s. 6d.)

This is a book with a purpose. It sets out to describe the life of a prostitute and presents it from the most sordid and degrading angle. It is cast in the form of a novel and is supposed to be the autobiography of an educated woman of good family who, after an unsuccessful marriage, decides to break away from all the conventions of normal living and takes to the streets. It certainly comes in the category of H X, for it will undoubtedly prove horrific to the large majority of women readers and to many men.

As a documentary, it is somewhat vitiated by the fact that the woman was obviously not of the ordinary prostitute type, and the experiences described do not agree with some of the facts. For example, she says that she operated in Half Moon Street, the centre of the fashionable West End, and states that she plied her trade in a duffle coat and jeans, received very small fees, and took her clients to a most unsavoury and sordid room. In fact, Mayfair prostitutes dress extremely well, only go with rich clients who pay them highly,

and usually have well furnished apartments which would be acceptable to men of the wealthier class. What she describes could only happen in the poorer parts of the East End. This makes one a little suspicious that the book is not in fact an autobiography but is dressed up for the purpose of showing prostitution in its worst light. This may well be highly desirable, but it cannot be regarded as entirely accurate.

The book is vividly written and holds the reader's interest. The ending is somewhat vague and inconclusive; from the psychological point of view one feels very doubtful whether a person of this character would ever make a satisfactory adaptation to life. The woman's personality is not wholly convincing and she never really comes alive.

On page 72, however, she says with considerable truth, "If you ask a prostitute what led her to go on the game the answer you will receive is almost sure to be superficial, either because she won't or because she can't give you the real reason whose roots will be the roots of her life".

The book appears opportunely when public interest has been aroused in the subject of prostitution by the passing of the new Street Offences Act. It should serve a valuable purpose in making those who read it think seriously about the many problems involved, both from the angle of demand and supply, and especially from the point of view of the possibility of preventing girls from taking up this kind of life, or of helping those who have done so in the early stages before the pattern has become so deeply established that they have neither the will nor the capacity to change. Undoubtedly, it was a book worth writing and it is worth reading.

D.M O.

ACCIDENTS—HOW THEY HAPPEN. No. 42, January, 1960. (H.M. Stationery Office. Quarterly. Price 1s. 3d.)

This quarterly publication describes selected accidents which have occurred at factories, docks, building operations, and works of engineering construction during the period under review. Each incident is described so as to exemplify a principle of accident prevention. With the excellent graphic illustrations provided, it offers clear teaching in this field.

As in previous issues, there are sections covering process machinery, electrical, machine tools, and building and constructional work, and, as usual, less common or more specialised types of hazards are included. About a third of this issue deals with dangers arising from the manufacture, processing and handling of toxic materials and indicates, in addition to reportable cases, the dangers lying in chronic poisoning which may not be recognised as such.

The principles of prevention in this field are mentioned and exemplified. Where substitution of non-toxic substances is impracticable the choice lies in enclosed processes, but where manipulation is essential the frame cupboard type of extractor is preferable to local exhaust hoods, and a case is cited to show the danger of relying on general ventilation. Other cases show the dangers of unexpected gas arising from inadvertant heating or mixing of chemicals, and the importance of labelling is stressed. Accidents occurring in maintenance work are cited, showing what precautions are necessary including the appropriate use of breathing apparatus.

A short statement is included for the first time of accident statistics.

S. M. F. CRESSALL.

CCHE SUMMER SCHOOL 1960

MAKING HEALTH MATTER is the title of the 1960 Summer School in Health Education, which will take place from 9th to 19th August at the Froebel Educational Institute in London. The major part of the programme is arranged on a new plan, which omits the formal group discussion periods of previous years. In their stead several " forums " have been devised at which experts in the subjects under consideration will present short papers as a basis for the discussion of such topics as juvenile delinquency, the community care of the mentally ill, recent progress in medicine, and the problems of public health workers. One experimental group discussion session is planned, at which an attempt will be made to measure the effectiveness of group discussion in attitude changing. More time has been allowed for practical work, and the lecture-demonstrations on the techniques of health education have been retained. A copy of the preliminary programme can be obtained on application to the Medical Director, Central Council for Health Education, Tavistock House, Tavistock Square, London, W.C.1.

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